

## Remote Control Technology for Applying Shotcrete “T-iROBO™ Remote Shotcreting”

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During construction of mountain tunnels in Japan, occupational accidents have often occurred due to rocks and shotcrete falling from the face. As workers near the face must work in high dust environment, it has been a challenge to improve the safety of workers and the work environment near to tunnel face. To improve this situation, we developed “T-iROBO Remote Shotcreting,” a system that allows spraying work done remotely from the operator's seat of the sprayer using a head-mounted display (HMD). This technology consists of multiple devices (Fig. 1). The system allows the operator, who is wearing the HMD, to remotely operate the sprayer from the driver's seat by viewing images from multiple cameras. The spraying operator can conduct the spraying work as if the tunnel is nearby by looking at the three-dimensional images of the face via HMD. Moreover, from the images taken by both stereo cameras and HMD, the operator can detect the spraying thickness with high accuracy. The stereo cameras are installed at two locations: the front of the operator's seat, where the operator can have a bird's-eye view of the entire spraying area, and the bottom of the man cage, where the operator can change the position of the camera to check the details of the spraying. Images from these cameras can be easily switched to be shown on the HMD, so the operator can remotely control the machine without any blind spots. This technology has been used at three mountain tunnel construction sites in Japan, and its safety and effectiveness have been confirmed.

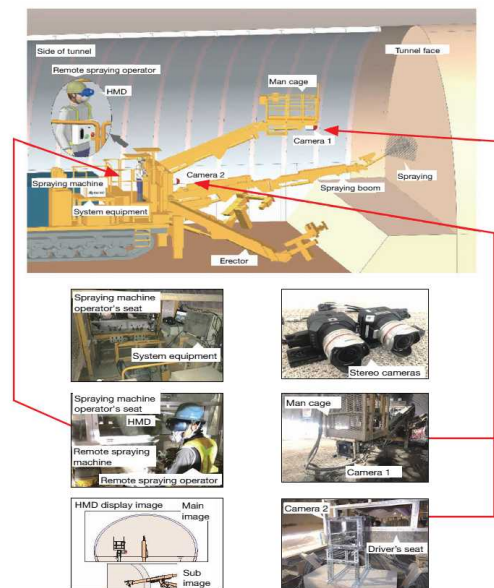


Fig. 1 T-iROBO Remote Shotcreting